
Fireworks — Category 4 —

**Part 3:
Test methods**

*Artifices de divertissement — Catégorie 4 —
Partie 3: Méthodes d'essai*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 264, *Fireworks*.

A list of all the parts in the ISO 26261 series can be found on the ISO website.

Fireworks — Category 4 —

Part 3: Test methods

1 Scope

This document specifies test methods for fireworks of Category 4.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Callipers; Design and metrological characteristics*

ISO 26261-1, *Fireworks — Category 4 — Part 1: Terminology*

ISO 26261-2:2017, *Fireworks — Category 4 — Part 2: Requirements*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 26261-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Test environment for functioning test

4.1 General

The test environment shall be a large unobstructed area, which shall be wide open. The measuring points shall be positioned appropriately for the type of measurement being carried out.

For aquatic fireworks, a water test area shall be available for testing the resistance to moisture and functioning in the expected manner.

4.2 Wind measurement

The wind speed at a height of 1,50 m above the ground shall be measured and recorded using a wind speed meter (see 5.5). No performance testing shall be carried out if the wind speed exceeds 5,0 m/s.

5 Apparatus

Any equivalent apparatus with the same accuracy or better may be used.

5.1 Timing device, capable of being read to the nearest 0,1 s.

5.2 Calliper, flat faced vernier calliper reading to 0,1 mm, conforming to ISO 13385-1.

5.3 Ruler, with a scale resolution of 1,0 mm or better.

5.4 Measuring tape, with a scale resolution of 10 mm or better.

5.5 Wind speed meter, accurate to at least 0,5 m/s.

5.6 Balance, with an accuracy of $\pm 0,01$ g or better.

5.7 Temperature chamber.

5.7.1 Up to $(50 \pm 2,5)$ °C.

5.7.2 Up to $(75 \pm 2,5)$ °C.

5.8 Sound level meter of class 1 conforming to IEC 61672-1 with a free-field microphone.

5.9 Shock apparatus, providing a deceleration of 490 m/s^2 ($-50/+100$) m/s^2 (when measured at the centre of an unloaded platform) and the shock impulse duration (time elapsed from the starting of the machine's deceleration to the time in which the deceleration reaches its maximum value during each first shock pulse) shall be $2 \text{ ms} \pm 1 \text{ ms}$ working at a frequency of $1 \text{ Hz} \pm 0,1 \text{ Hz}$.

An example of an apparatus is shown in [Annex A](#).

5.10 Devices for measuring heights.

Heights shall be measured using universal surveying instruments (USI) such as theodolites, electronic spirit levels or video (visible and/or infrared) systems.

Examples of measuring methods and the calculation of the height are given in [Annex B](#).

5.11 Goniometer, reading to 1° or better.

5.12 Mortar.

The rising height of shells depends particularly on the clearance of the shell in the mortar [ratio of the maximum cross section area of the shell (A_{shell}) to the inner cross section area of the mortar (A_{mortar})], also designated as " Q ". Q is the ratio of the outer diameter of the shell ($d_{\text{o,shell}}$, including the fuse to the lifting charge) squared over the inner diameter of the mortar ($d_{\text{i,mortar}}$) squared. The outer diameter of the shell shall be measured horizontally at the place of largest diameter including the fuse to the lifting charge. The conditions given in [Formula \(1\)](#) and [Formula \(2\)](#) shall be achieved:

$$0,9 \leq Q = \frac{A_{\text{shell}}}{A_{\text{mortar}}} = \frac{d_{\text{o,shell}}^2}{d_{\text{i,mortar}}^2} \leq 0,98 \quad (1)$$

$$\sqrt{1,02 \cdot d_{o,shell}^2} \leq d_{i,mortar} \leq \sqrt{1,1 \cdot d_{o,shell}^2} \quad (2)$$

For calibre ≤ 100 mm, a wider tolerance can be accepted. The conditions given in [Formula \(3\)](#) and [Formula \(4\)](#) shall be achieved:

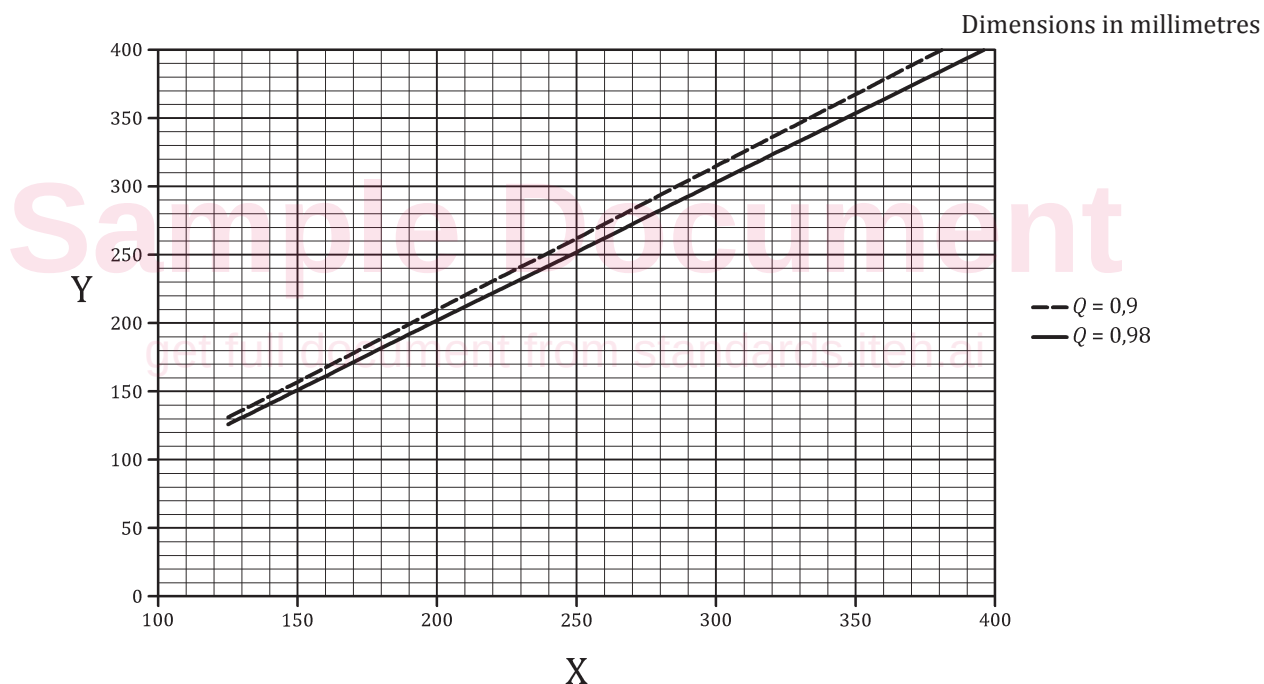
$$0,83 \leq Q_{\leq 100}^* \leq 0,98 \quad (3)$$

$$\sqrt{1,02 \cdot d_{o,shell}^2} \leq d_{i,mortar}^* \leq \sqrt{1,2 \cdot d_{o,shell}^2} \quad (4)$$

For calibre > 400 mm, the clearances shall be determined according to the safety standard of manufacturer.

Another determining factor influencing the rising height is the length of the mortar (l_{mortar}) – length from the mortar muzzle to the mortar ground.

The dimensions of the mortar may also be determined from [Figure 1](#), [Figure 2](#) and [Figure 3](#).



Key

X calibre of the shell

Y internal diameter of the mortar

Figure 1 — Dimensions of the mortars for spherical shells — Calibre above 100 mm